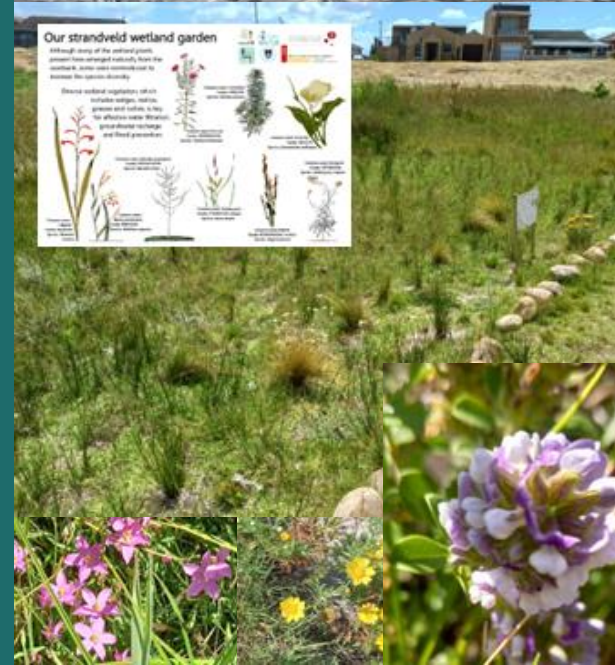


Nature-Based Solutions for Water Resilience

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BC Housing

May 20, 2026



01

REFRAMING WATER RESILIENCE

Water Is More Than Flooding: Reframing Water Risk in the Built Environment

Fragmented water management lens	Integrated water resilience
Flooding & drainage Sewer & infrastructure failure Emergency response Regulatory compliance Site-by-site mitigation	Watersheds & ecosystems Green infrastructure Urban cooling & retention Community liveability Multi-benefit adaptation

Water resilience is not only about managing hazards — it is about strengthening the interconnected systems that support long-term community resilience

The Growing Water Challenge: Too much, too little, too dirty

Too Much

Flooding & excess water

- Extreme rainfall
- Stormwater overload
- Erosion & runoff
- Sewer backup
- Infrastructure damage



Too Little

Drought & water scarcity

- Prolonged dry periods
- Water restrictions
- Declining watershed health
- Landscape stress & tree loss
- Reduced stream flows
- Wildfire risk amplification



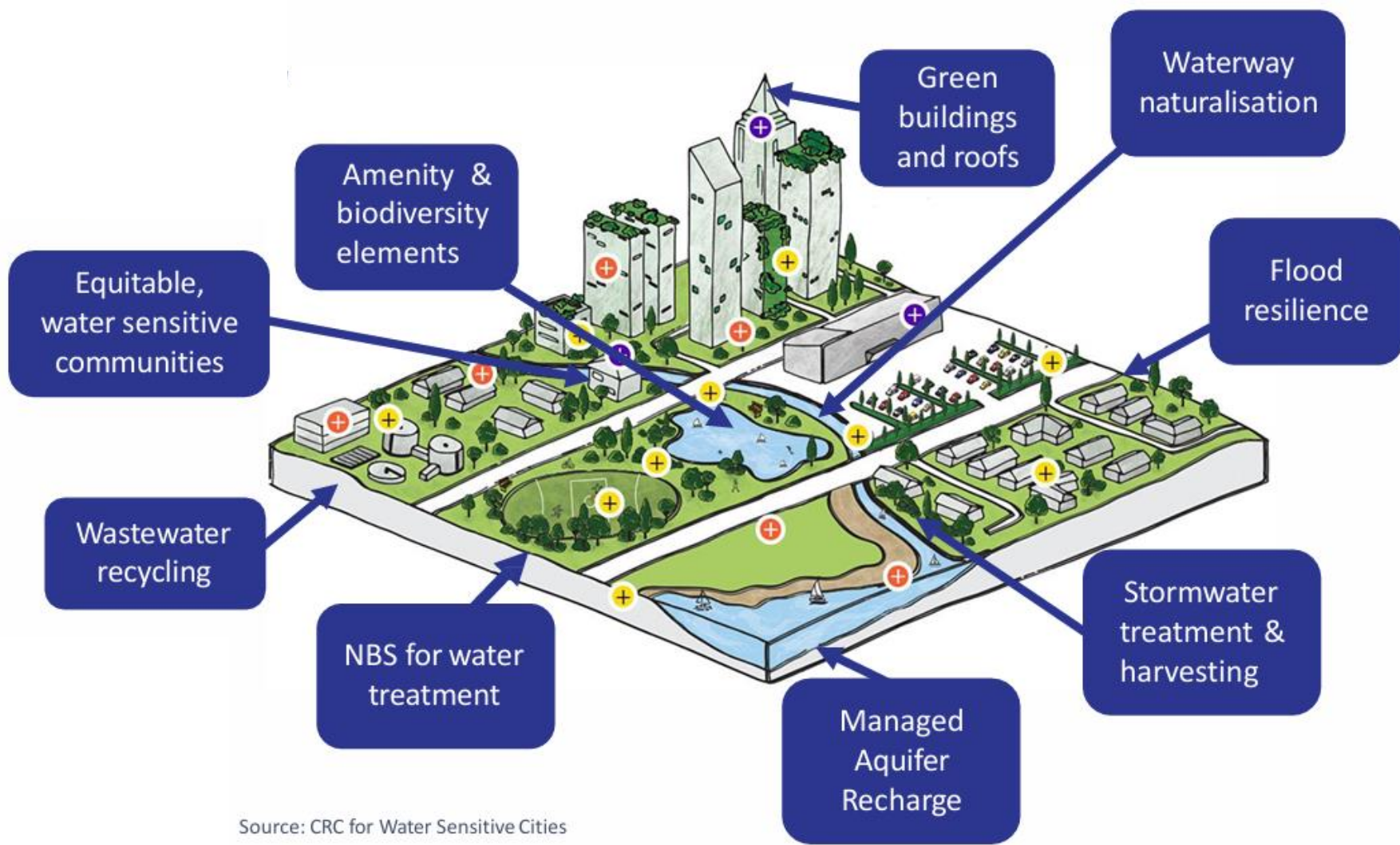
Too Dirty

Water quality & ecosystem degradation

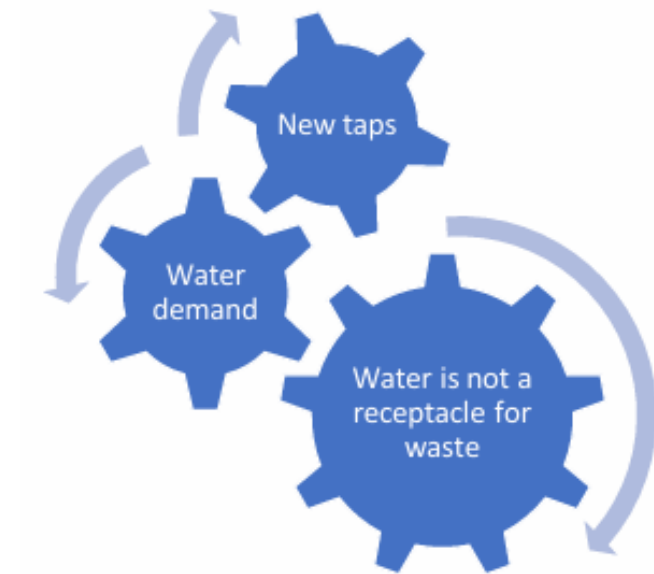
- Polluted urban runoff
- Sedimentation & contaminants
- Sewer overflows
- Warmer water temperatures
- Ecosystem degradation
- Public health concerns



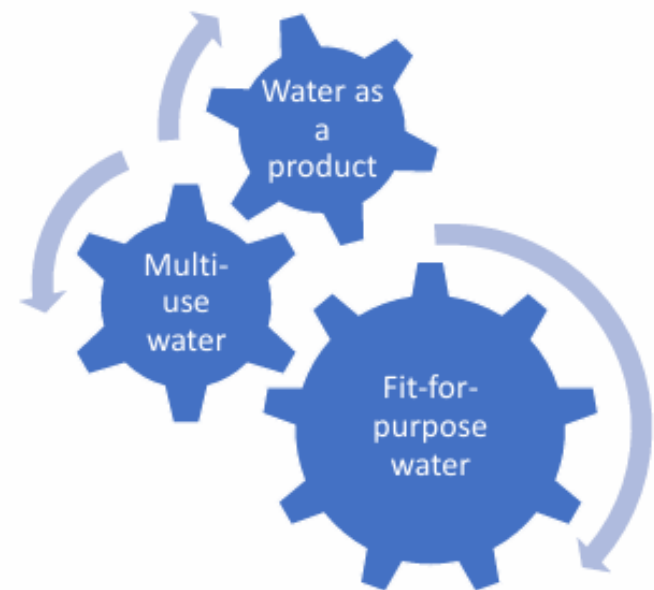
Nature-based solutions can help address water quantity, water quality, and ecosystem resilience together rather than separately



Source: CRC for Water Sensitive Cities



New sources



New thinking

Water Sensitive & Resilient Cities

- Multi-functional infrastructure - hybrid between centralised and decentralised
- Blue / green corridors as integral elements of city's drainage infrastructure
- Stormwater as a resource, not waste
- Nature's ecosystem services role in treating, filtering run-off
- Reuse, recharge & diversify water sources

Design principle – “keep water in the town / city”



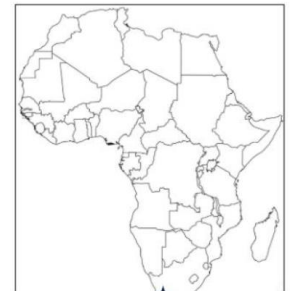
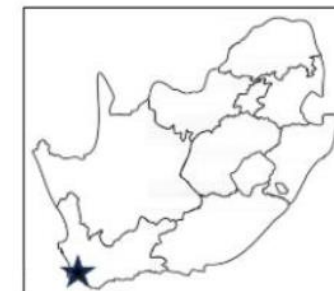
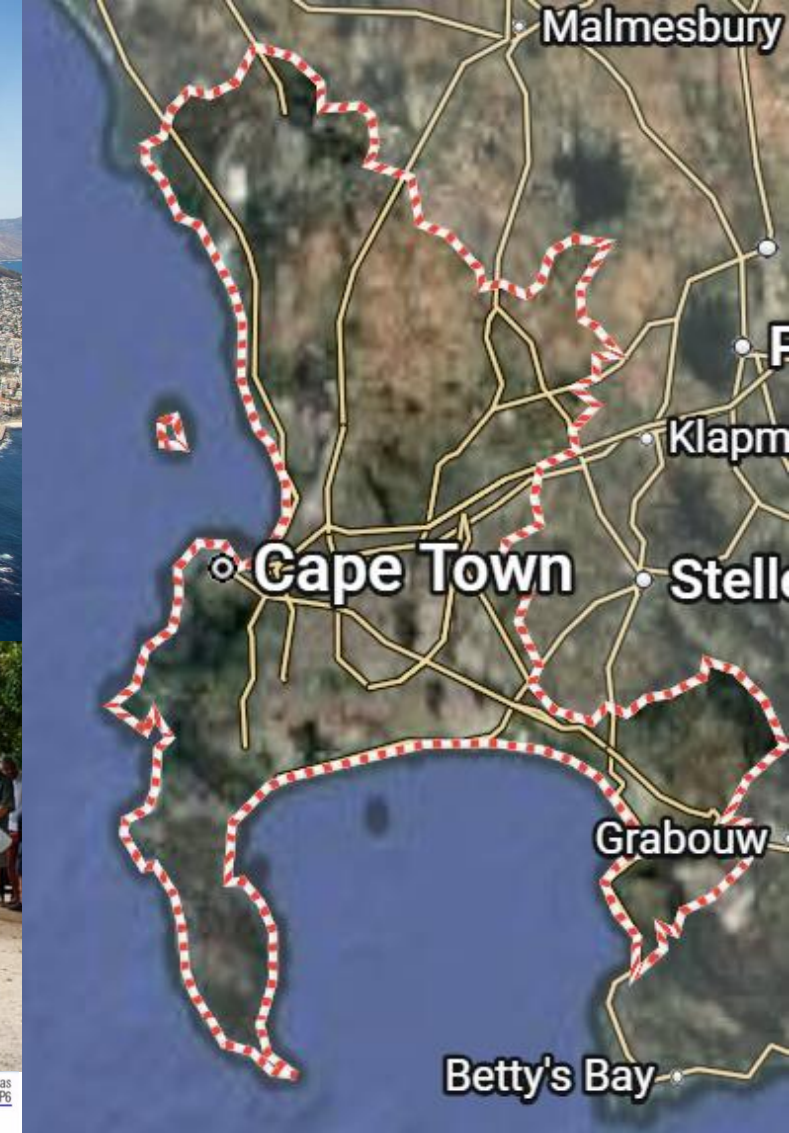
02

CAPE TOWN & DAY ZERO WATER CRISIS

Water scarcity as a systems shock

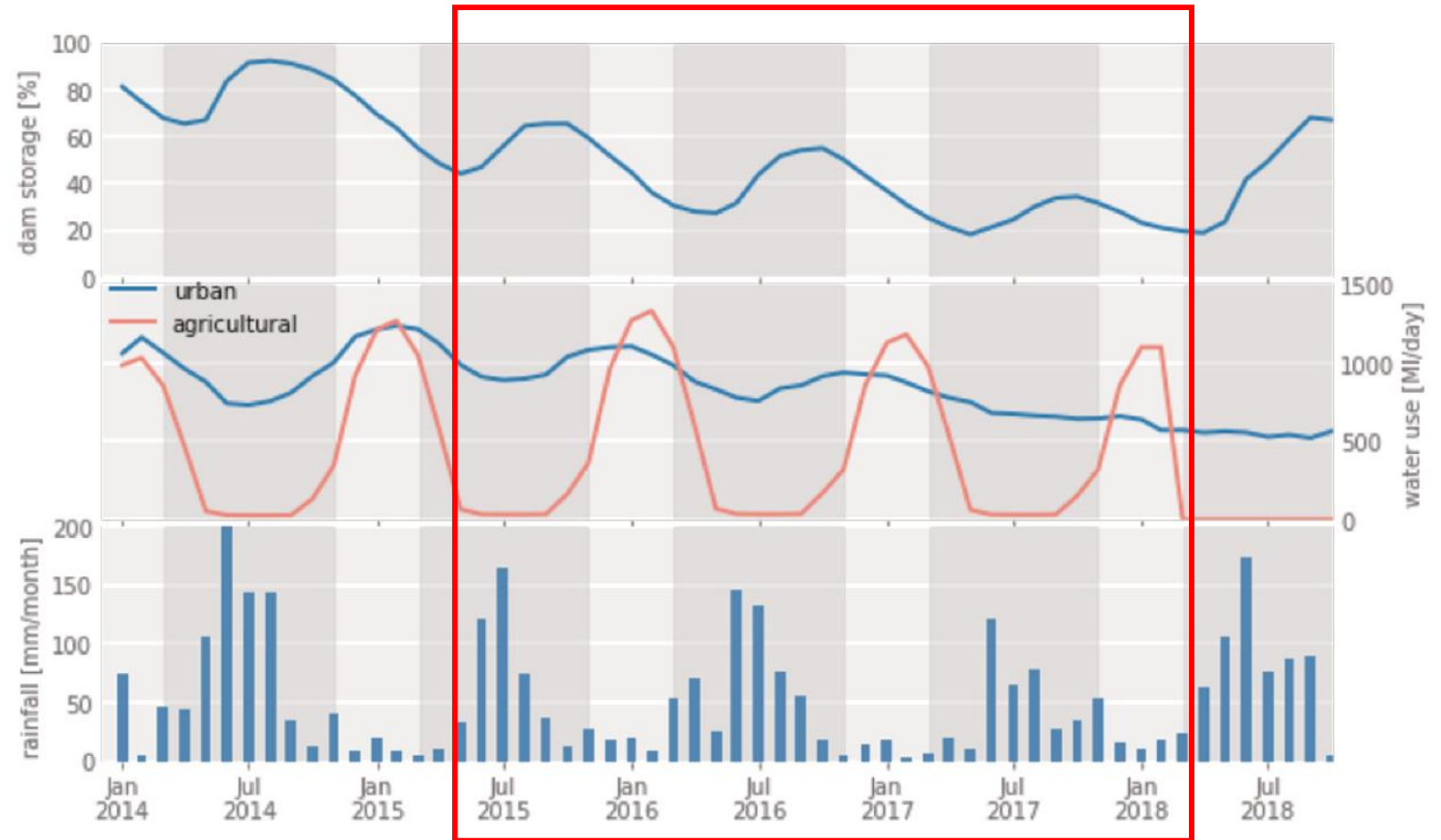
Cape Town, South Africa

- Coastal city bound by mountains and ocean, urbanizing
- ~4.8 million people
- Mediterranean climate
- Winter rainfall dependent
- Experienced the “Day Zero” water crisis (2015–2018)

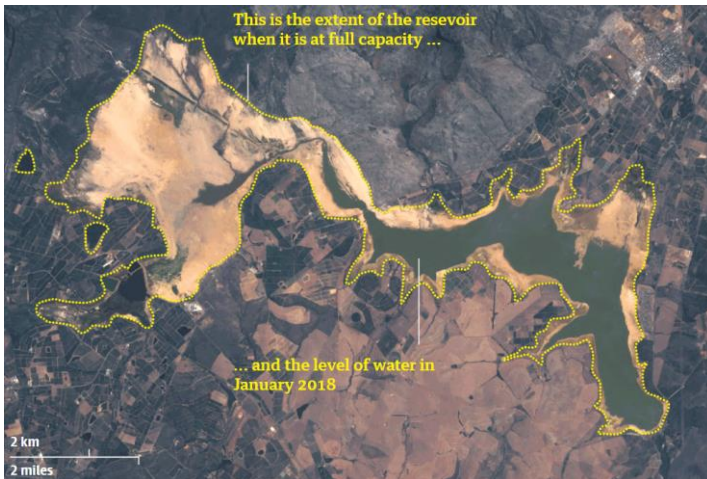


- Day Zero = projected point at which Cape Town would shut off municipal taps due to low dam levels (13%)
- 2015–2018: severe multi-year drought, rainfall falling to ~50–70% of the long-term average.
- 2017: rainfall records lowest since 1880s.
- Reduced rainfall and runoff caused major declines in dam storage: 2014: 100% → 2015: 71% → 2016: 60% → **2017: 38%**
- 6 largest rainfed dams provide >99% of system water storage

Day Zero - Cape Town's water crisis



(Source: cip.csag.uct.ac.za/monitoring/bigsix.html)



Day Zero averted

- Day Zero - queue for water at 200 collection points for 25l/pp/d
- Water conservation and demand management measures
- Stepped water restrictions and punitive tariff structure – 50L/pp/d
- Water Management Devices (350L/household/d)
- Pressure & leak management
- Behavioral & public education campaigns
- Source diversification
- City Water strategy



CAPE TOWN WATER STRATEGY

- our shared water future -
APRIL 2019



COMMITMENT 5: A WATER SENSITIVE CITY

The City will actively facilitate the transition of Cape Town over time into a **water sensitive city** with **diverse water resources**, diversified infrastructure and one that makes **optimal use of stormwater** and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and that is based on sound ecological principles This will be done through new **incentives and regulatory mechanisms** as well as through the way the City makes **investments in new infrastructure**.

03

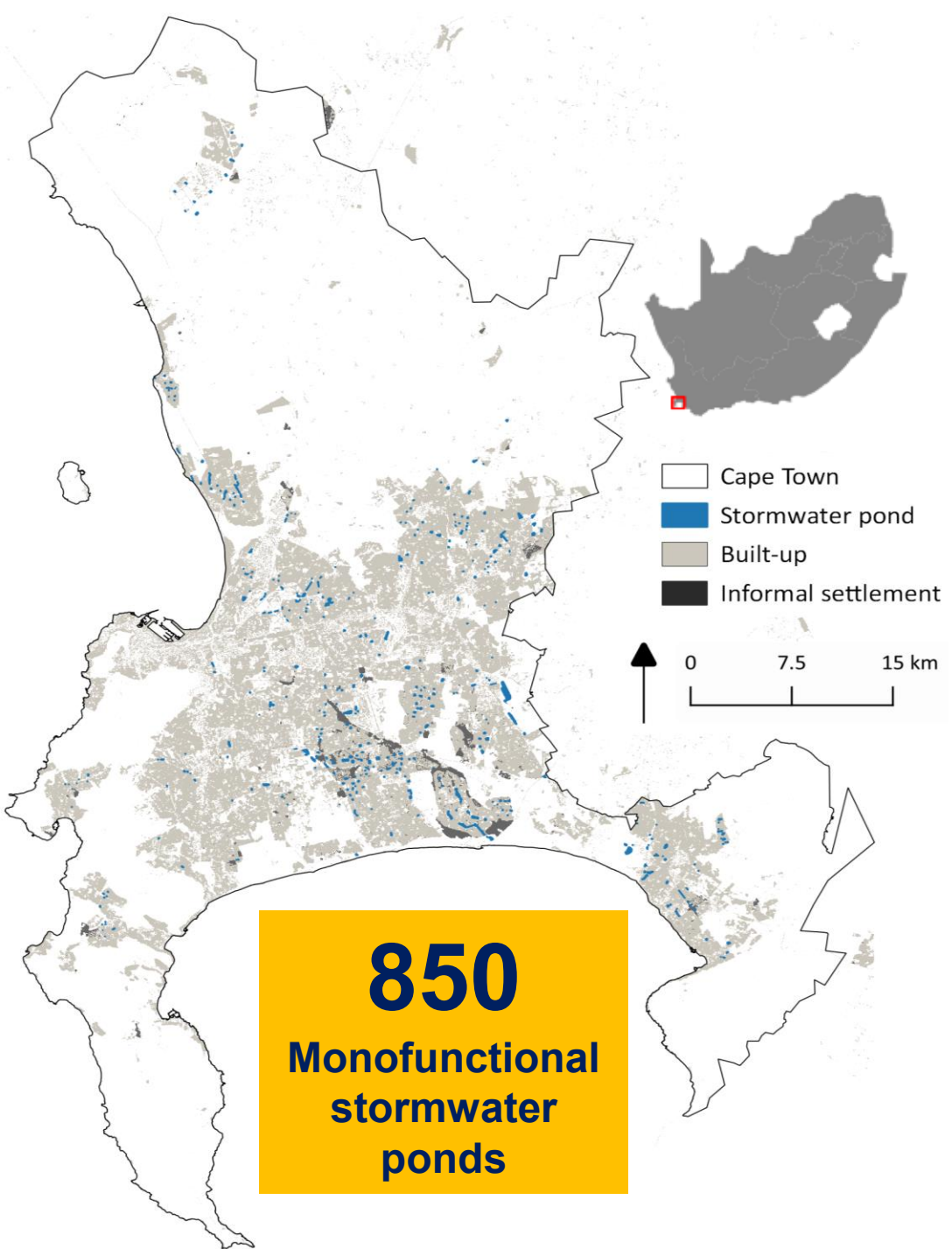
RETROFITTING STORMWATER INFRASTRUCTURE FOR MULTIFUNCTIONALITY

Case studies

Pathways to water resilient South African cities

- Nature-based approaches that link storm runoff and wastewater to water supply in a decentralized manner
- Low-cost retrofitting of stormwater ponds to allow for infiltration and treatment of contaminated runoff
- Stakeholder engagement, co-creation of multifunctional infrastructure with local residents
- Facilitating enabling governance environment for increased water resilience
- Physical and institutional integration pathways (planning, policy)
- Partnered with metro municipality





Evaluate the potential of Cape Town's existing 850 stormwater ponds to provide multi-functional benefits as Nature-Based Solutions (Jessica Fell, PhD topic)

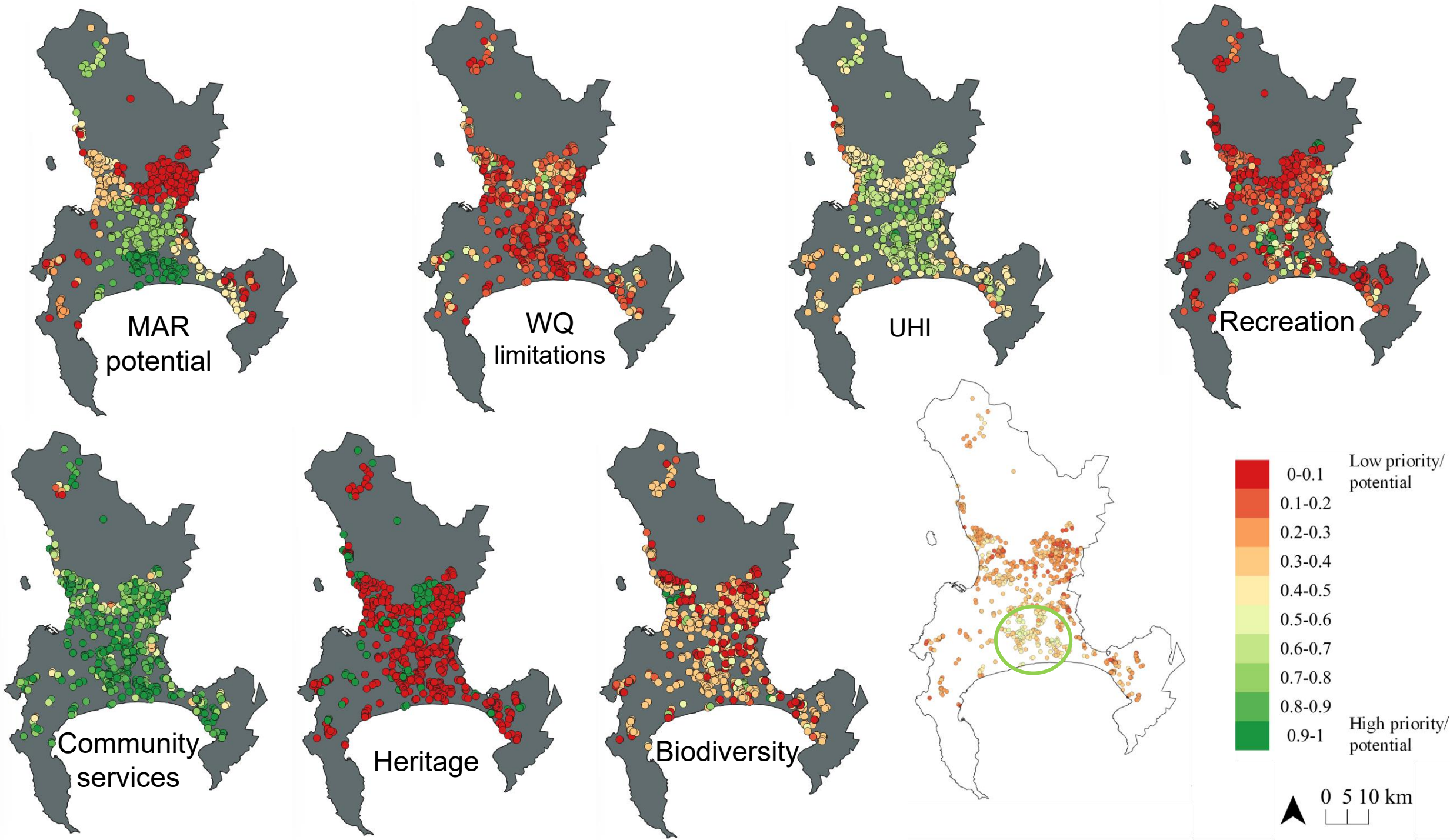
850 monofunctional stormwater ponds with potential for retrofit to provide multi-functional benefits such as managed aquifer recharge, amenity and biodiversity.

Multifunctionality is explicitly and strategically planned for, rather than being a product of chance



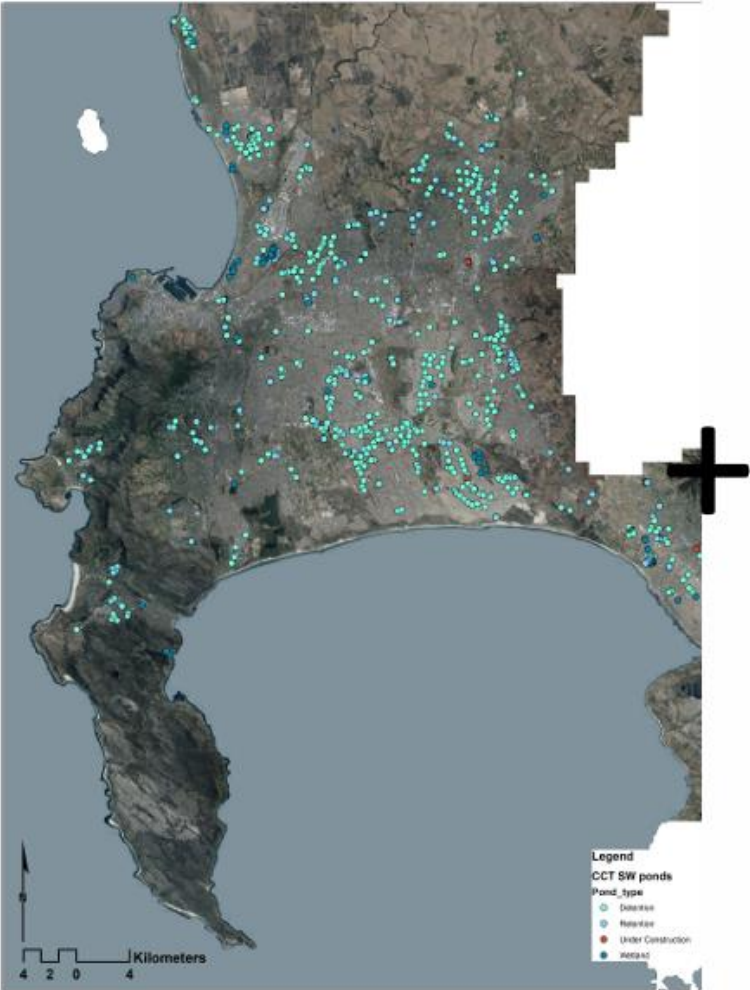
Source: Craig Tanyanyiwa

01 Results	Water Sensitive City planning priority	Criterion and attributes
	Enhancing cultural and heritage associations with water systems	Pond proximity to culture and heritage resources (City of Cape Town (2019))
	Increasing water re-use	Managed Aquifer Recharge Potential (Aquifer presence and type, Transmissivity, Soil Type, Geology) (WR2012 (2012), City of Cape Town (2022))
	Reducing the Urban Heat Island effect	Heat Islands Risk at pond (land cover classes, daily normalised, irradiation and windspeed) (City of Cape Town (2022))
	Community services connection with water systems	Pond proximity to schools, community centres and religious institutions (City of Cape Town (2019))
	Increasing access to blue-green space	Recreation potential (Mean population density and park presence in 500m pond radius) (City of Cape Town (2019), StatsSA (2012))
	Incorporating water quality limitations	Pond proximity to Potential Contaminating Activities (informal settlement, industrial, landfill, wastewater treatment works,) (DFFE (2021), City of Cape Town (2019))
	Enhancing biodiversity	Wetland category of pond (Freshwater Consulting, 2009))

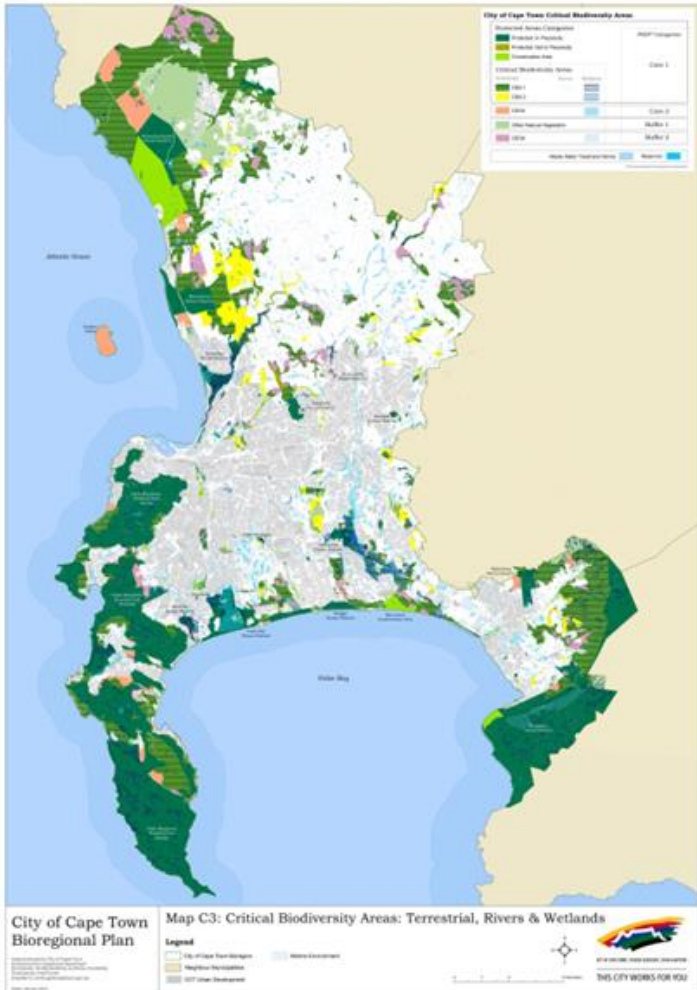


POTENTIAL OF STORMWATER PONDS AS BLUE-GREEN INFRASTRUCTURE

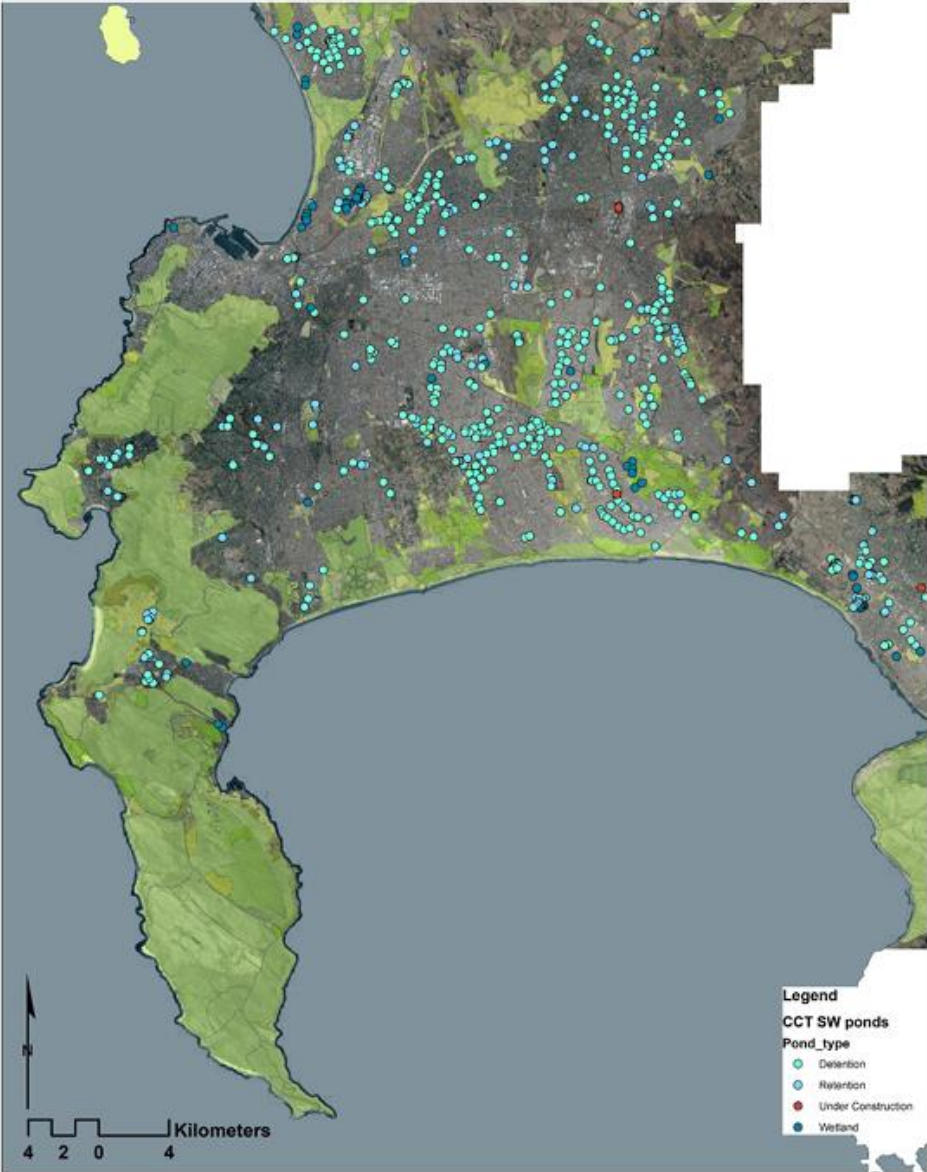
STORMWATER PONDS
AS POTENTIAL BIODIVERSITY



CAPE TOWN'S
CRITICAL BIODIVERSITY AREAS



=



BLUE-GREEN STEPPING STONES



UNIVERSITY OF
COPENHAGEN



MINISTRY OF FOREIGN AFFAIRS OF DENMARK
DANIDA INTERNATIONAL
DEVELOPMENT COOPERATION

Case Study: Stormwater pond retrofit

PONDS AS NEGLECTED LAND....



Before and during construction

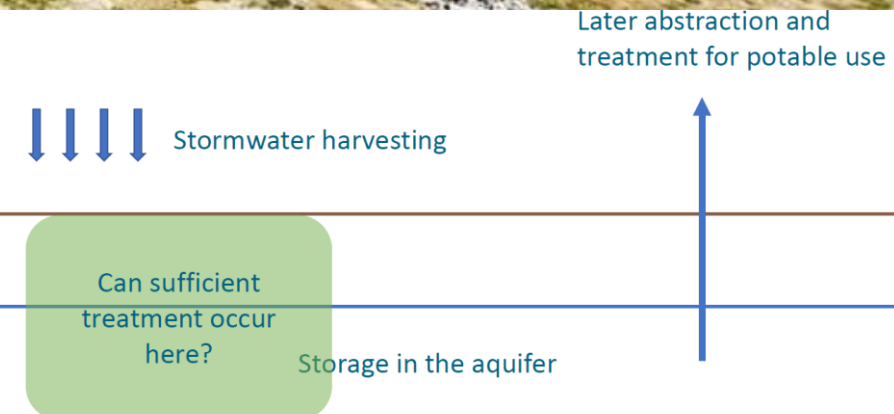
6



POND RETROFIT : JULY-SEPT 2021



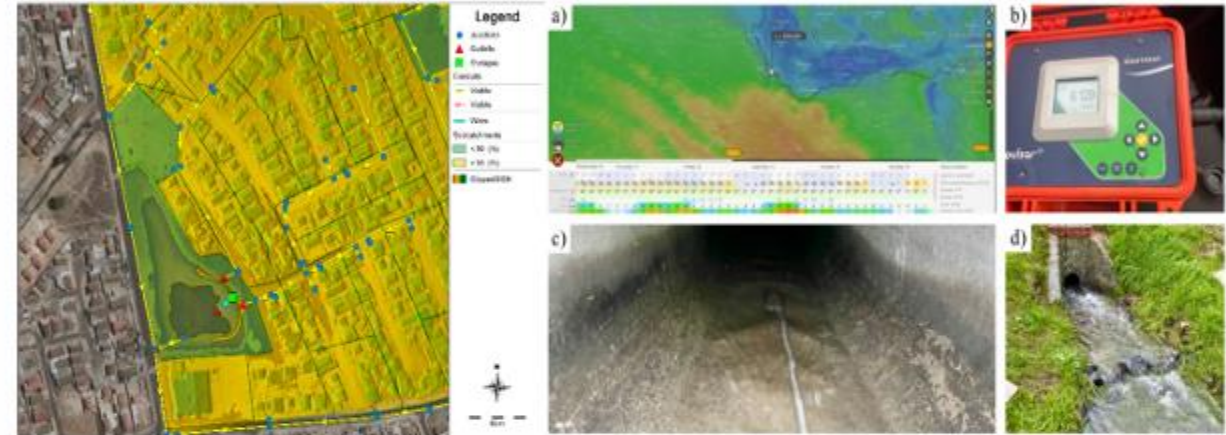
Image source: Dr Craig Tanyanyiwa



Experimental work – Phase 1

Hydraulic Performance

The volume of water that can be harvested in the swale, was determined using a PCSWMM based hydraulic model



Treatment Performance

1. *Field monitoring* - Groundwater monitoring wells were installed across the site at various depths and monitored for 1 year
2. *Column Experiments* - 6 PVC columns, 2 m tall, were packed with 1.5 m of soil and aquifer material from the site , while 2 were packed with silica sand



After construction – Phase 1



Key Findings – Phase 1

1. Low-cost retrofitting is possible but requires residents' consent and input
2. #Co-Design, #Co-Implement , #Co-Maintain
3. High water table is a technical challenge
4. Retrofit can increase infiltration by 15 %
5. Future scenarios result in more SWH (110%)
6. Even 0.5m of soil can remove > 76% of metals and Phosphorus
7. Retrofitted ponds can improve groundwater quality

Total retrofit cost: R300 000

Engagement: R10 000

Retrofit Design: R39 000

Materials: R49 000

Labour & PPE: R42 000

Monitoring Wells: R68 000

Topographical Surveys: R49 000

Other: R43 000

Multifunctional infrastructure



Increasing water re-use

Enhancing cultural and heritage associations with water systems

Increasing access to blue-green space

Increasing equity

Reducing the Urban Heat Island effect

Managing water quality

Flood control

Community services connection with water systems

Enhancing biodiversity



Journey of stormwater

- Source to Sea
- Biodiversity and Nature (plants and animals)
- Ecosystem services
- Cape Flats Aquifer / groundwater
- Connected stormwater systems and pollution impacts
- Eco-friendly paints
- Project QR code

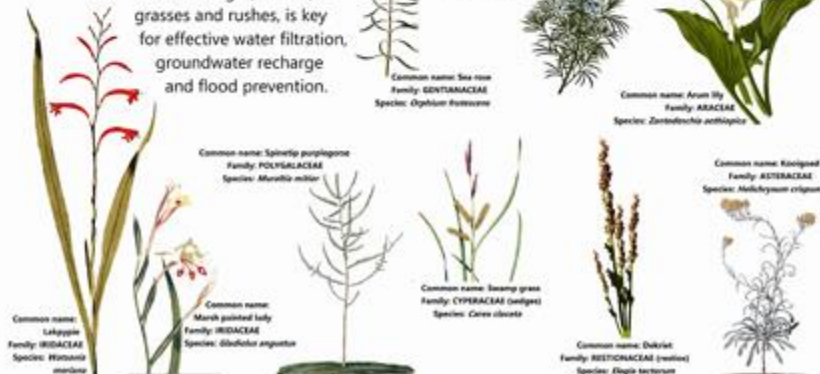




Our strandveld wetland garden

Although many of the wetland plants present here emerged naturally from the seedbank, some were reintroduced to increase the species diversity.

Diverse wetland vegetation, which includes sedges, restios, grasses and rushes, is key for effective water filtration, groundwater recharge and flood prevention.



DEMO SITE @ FULHAM RD - FROM MOWING TO GROWING A WETLAND



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OBSERVATIONS OF INCREASING BIODIVERSITY: JULY 2023, CURATING A BIODIVERSE LANDSCAPE WITH FYNBOSLIFE



Critically endangered
Psoralea glaucina



Highly threatened Barber's Cape Flats Ranger
Butterfly (left)



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DANIDA

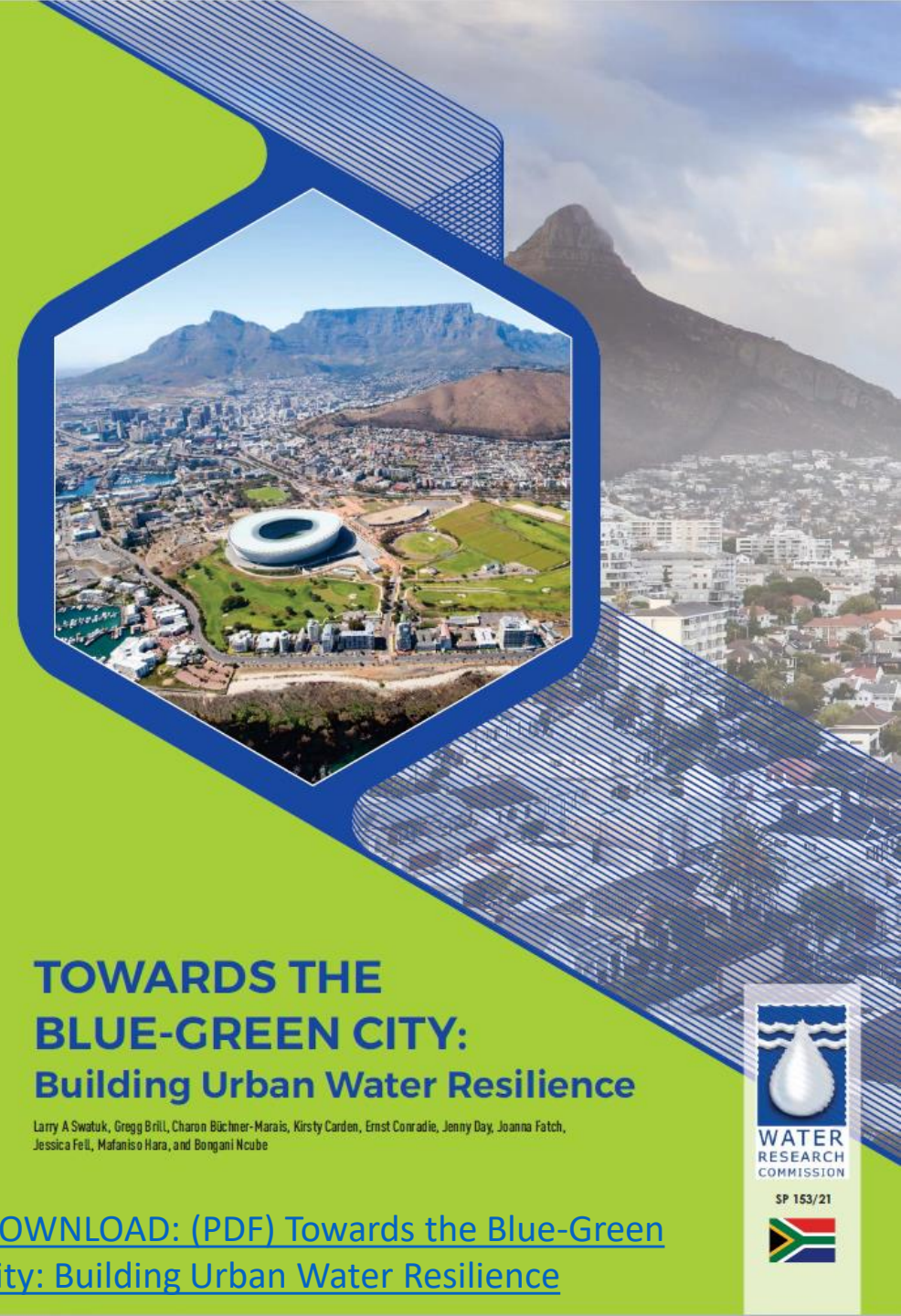
INTERNATIONAL
DEVELOPMENT COOPERATION

THANK YOU

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TOWARDS THE BLUE-GREEN CITY: Building Urban Water Resilience

Larry A Swatuk, Gregg Brill, Charon Büchner-Maraïs, Kirsty Carden, Ernst Conradie, Jenny Day, Joanna Fatch,
Jessica Fell, Mafaniso Hara, and Bongani Ncube

[DOWNLOAD: \(PDF\) Towards the Blue-Green
City: Building Urban Water Resilience](#)



SP 153/21